diets is 30 mg Zn/kg.[100] The consequent Zn:Cu ratio in a beef cattle diet is 3:1. The ratio of Zn to Cu in cattle waste samples collected in the Illinois River Watershed by CDM ranged from 4.237:1 to 8.901:1 with an average value of 6.102:1. In contrast, the analysis of poultry feed obtained by CDM[101] had a measured zinc concentration of 128 mg/kg and a measured copper concentration of 119 mg/kg or a Zn:Cu ratio of 1.076:1, a value very different from those in beef cattle diets or in cattle waste, but quite similar to the Zn:Cu ratio of 1.317:1 for the average values of Zn and Cu measured by CDM in poultry wastes.

18. The chemical composition of poultry waste is distinctly different from the chemical composition of cattle waste and waste water treatment plant effluent. Crossplots of Total P, Total Zn, Total Cu and Total As that compare poultry waste, cattle waste and wastewater treatment plant effluent are provided in Fig 8.[102] Cattle waste is chemically distinguishable from poultry waste. Cattle waste contained substantially less (~ 16 times less) Total P per unit mass than poultry waste, and contained no detectable Total As. Further, cattle waste contained much less Total Zn (~22 times less) and Total Cu (~115 times less) than poultry waste, and the ratio of Total Zn to Total Cu in cattle waste is larger (~4.6 times) than the ratio of Total Zn to Total Cu found for poultry waste. Wastewater treatment plant effluent is also chemically distinguishable from poultry waste. Compared to poultry waste, wastewater treatment plant effluent is depleted in Cu (~2.7 times less) but enriched in Zn (~3.4 times more) and As (~4.9 times more) with respect to Total P.

Data concerning the ratios Total Zn/Total P, Total Cu/Total P, Total As/Total P and Total Zn/Total Cu in poultry waste, cattle waste and wastewater treatment plant effluent are

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100 See Chapter 5, National Research Council , 2000. Nutrient Requirements of Beef Cattle: Seventh Revised Edition: Update 2000, National Academy Press, 232 pp.

101 Sample ID FAC 01-FEED.

102 Sample IDs: Litter 3, Litter 4, Litter 2, Litter 5, FAC 01A (020206-Normal 1), FAC 01B (020206-Normal 2), FAC-06, FAC-04, FAC-05, FAC1, FAC2, FAC-07, FAC-03, FAC-08, FAC09, FAC-10, LAL1-A-Compost, FAC 1-C (020206-Cake), FAC-11, FAC-12-113007, FAC-12-112907, FAC-14, FAC-15, FAC-16, FAC-17; MAN-BC-20D; MAN-BC-20F; MAN-BC-21D; MAN-BC-21F; MAN-BC-22D; MAN-BC-22F; MAN-BC-23D; MAN-BC-23F; MAN-BC-24D; MAN-BC-24F; MAN-BG-20F; Lincoln WWTP-01 Non-filtered; Rogers WWTP Non-filtered; Silom Springs WWTP Non-filtered; Springdale WWTP Non-filtered , Lincoln WWTP-01 Non-filtered.

Exhibit A

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given in Table 12. The ratio of Zn to P (Zn/P) in poultry waste ranged between 0.0174:1 and 0.0322:1 with an average value of 0.0253:1. In comparison, the ratio of Zn to P in cattle waste ranged from 0.0107:1 to 0.0375:1 with an average value of 0.0.199:1 while in wastewater treatment plant effluent (unfiltered) the ratio of Zn to P ranged from 0.0108:1 to 0.2109:1 with an average value of 0.0864:1. With respect to P then, on average, Zn is approximately 1.26 times more abundant in poultry waste than in cattle waste, but more than 3.4 times less abundant in poultry waste than in wastewater treatment plant effluent.

The ratio of Cu to P (Cu/P) in poultry waste ranged between 0.0045:1 and 0.0282:1 with an average value of 0.0213:1. In comparison, the ratio of Cu to P in cattle waste ranged from 0.0019:1 to 0.0051:1 with an average value of 0.0032:1 while in wastewater treatment plant effluent (unfiltered) the ratio of Cu to P ranged from 0.0015:1 to 0.0178:1 with an average value of 0.0079:1. With respect to P then, on average, Cu is approximately 6.6 times more abundant in poultry waste than in cattle waste and 2.8 times more abundant in poultry waste than in wastewater treatment plant effluent.

The ratio of As to P (As/P) in poultry waste ranged between 0.0001:1 and 0.0022:1 and had an average value of 0.0012:1. In comparison, no arsenic was detected in cattle waste; while in wastewater treatment plant effluent (unfiltered) the ratio of As to P ranged from 0.0004:1 to 0.0103:1 with an average value of 0.0060:1. With respect to P then, As is approximately 4.9 times more abundant in wastewater treatment plant effluent than in poultry waste.

The ratio of Zn to Cu (Zn/Cu) in poultry waste ranged between 0.8933:1 and 4.7574:1with an average value of 1.3174:1. In comparison, the ratio of Zn to Cu in cattle waste ranged from 4.2367:1 to 8.9011:1 with an average value of 6.1021:1 while in wastewater treatment plant effluent (unfiltered) the ratio of Zn to Cu ranged from 5.7315:1 to 14.1905:1 with an average value of 9.7617:1. With respect to Cu then, on average, Zn is approximately 4.6 times more abundant in cattle waste than in poultry waste and 7.4 times more abundant in

wastewater treatment plant effluent than in poultry waste.

Given these differences in chemical ratios, these wastes are distinctly different from one another, and these differences can be used to identify the presence of these wastes in environmental samples.

Table 12.
Ratios of Total Zn/Total P, Total Cu/Total P, Total As/Total P and Total Zn/Total Cu for Poultry Waste, Cattle Waste and Wastewater Treatment Plant Effluent (unfiltered)

		Total Zn / Total P	Total Cu/'Total P	Total As/Total P	Total Zn/Total Cu
Poultry Waste	Maximum	0.0322	0.0282	0.0022	4.7574
	Q3	0.0273	0.0242	0.0019	1.3673
	Mean	0.0253	0.0213	0.0012	1.3174
	Median	0.0260	0.0220	0.0009	1.1149
	Q1	0.0216	0.0192	0.0001	1.0343
	Minimum	0.0174	0.0045	0.0001	0.8933
Cattle Waste	Maximum	0.0375	0.0051	As not detected	8.9011
	Q3	0.0276	0.0040	As not detected	6.8515
	Mean	0.0199	0.0032	As not detected	6.1021
	Median	0.0157	0.0030	As not detected	5.9554
	Q1	0.0131	0.0024	As not detected	5.4308
	Minimum	0.0107	0.0019	As not detected	4.2367
Wastewater Treatment Plant Effluent	Maximum	0.2109	0.0178	0.0103	14.1905
	Q3	0.1209	0.0093	0.0076	12.4273
	Mean	0.0864	0.0079	0.0060	9.7617
	Median	0.0619	0.0061	0.0065	9.5625
	Q1	0.0274	0.0047	0.0049	6.8969
	Minimum	0.0108	0.0015	0.0004	5.7315

19. The geology of the Illinois River Watershed produces a circumstance in which both the surface and ground water within the Illinois River Watershed are highly susceptible to pollution from the constituents of land applied poultry waste. The Illinois River Watershed contains approximately 1,672 mi^2 (1,069,530 acres), and lies within the southwestern portion (Springfield Plateau) of the Ozark Uplift physiographic province within portions of Washington and Benton Counties in Arkansas and Delaware, Adair, Cherokee and Sequoyah Counties in Oklahoma. Approximately 53% of the Illinois